

## **AMENDMENTS TO THE CLAIMS**

Please amend the claims as shown below.

Claim 1. (Nine times amended) A mutant prenyl diphosphate synthase having [a modified] the amino acid sequence[ , ] of SEQ ID NO:1, except that:

threonine at position 78 of SEQ ID NO:1 is replaced with phenylalanine replacing histidine at position 81 of SEQ ID NO:1 is replaced with alanine;

threonine at position 78 of SEQ ID NO:1 is replaced with phenylalanine and histidine at position 81 of SEQ ID NO:1 is replaced with leucine;

phenylalanine at position 77 of SEQ ID NO:1 is replaced with tyrosine, threonine at position 78 of SEQ ID NO:1 is replaced with phenylalanine, and histidine at position 81 of SEQ ID NO:1 is replaced with leucine;

phenylalanine at position 77 of SEQ ID NO:1 is replaced with tyrosine, threonine at position 78 of SEQ ID NO:1 is replaced with phenylalanine, and histidine at position 81 of SEQ ID NO:1 is replaced with alanine; or

phenylalanine at position 77 of SEQ ID NO:1 is replaced with tyrosine, threonine at position 78 of SEQ ID NO:1 is replaced with serine, valine at position 80 of SEQ ID NO:1 is replaced with isoleucine, isoleucine at position 84 of SEQ ID NO:1 is replaced with leucine, and proline and serine are inserted sequentially between position 84 and position 85 of SEQ ID NO:1

[wherein

said mutant prenyl diphosphate synthase comprises an aspartic acid-rich domain having the sequence,  $D_1D_2X_1X_2(X_3X_4)D_3$ , in region II of said mutant prenyl diphosphate synthase

wherein each of  $D_1$ ,  $D_2$ , and  $D_3$  denote an aspartic acid residue;  $X_1$ ,  $X_2$ ,  $X_3$ , and  $X_4$  are each independently any amino acid and  $X_3$  and  $X_4$  are each optionally independently present in the aspartic acid rich domain,

and wherein said mutant prenyl diphosphate synthase comprises (1) at least one amino acid substitution, said at least one amino acid substitution located at at least one amino acid position selected from (a) an amino acid between  $D_1$  and the amino acid residue at the fifth position upstream of  $D_1$  and (b) the amino acid residue located one amino acid position upstream

of D<sub>3</sub>; (2) at least one additional amino acid inserted between D<sub>3</sub> and the first amino acid upstream of D<sub>3</sub>; or a combination of (2) (1) and (3) (2);

wherein said mutant prenyl diphosphate synthase synthesizes prenyl diphosphate which is shorter than prenyl diphosphate synthesized by a corresponding wild-type enzyme].

Cancel claim 2.

Claim 3. (Two Times Amended) A mutant [enzyme] prenyl diphosphate synthase according to claim 1 wherein [the] a reaction product of the mutant prenyl diphosphate synthase is farnesyl diphosphate.

Claim 4. (Three Times Amended) A mutant [enzyme] prenyl diphosphate synthase according to claim 1 wherein the mutant prenyl diphosphate synthase [is of the homodimer-type] forms a homodimer.

Cancel claim 5.

Claim 6. (Three Times Amended) A mutant [enzyme] prenyl diphosphate synthase according to claim 1 wherein the mutant prenyl diphosphate synthase is [derived from] a mutant of a Sulfolobus acidocaldarius prenyl diphosphate synthase.

Claim 7. (Five Times Amended) A mutant [enzyme] prenyl diphosphate synthase according to claim 1 wherein the mutant prenyl diphosphate synthase is [a] more thermostable [enzyme] at 70° C or 80° C than the wild-type geranylgeranyl diphosphate synthase of Sulfolobus acidocaldarius.

Cancel claims 8-10.

Claim 11. (Amended) A DNA encoding [an enzyme] the mutant prenyl diphosphate synthase according to claim 1.

Claim 12. (Twice Amended) An RNA [transcribed from a DNA according to claim 11] encoding the mutant prenyl diphosphate synthase according to claim 1.

Claim 13. (Amended) A recombinant vector comprising [a] the DNA according to claim 11.

Claim 14. (Twice Amended) [A] An isolated host [organism] cell transformed with [a] the recombinant vector according to claim 13.

Claim 15. (Four Times Amended) A process for producing a mutant [enzyme] prenyl diphosphate synthase according to claim 1, said method comprising the steps of culturing [a] an

isolated host cell transformed with an expression vector comprising a DNA [coding for] encoding the mutant [enzyme] prenyl diphosphate synthase and [of] harvesting the [expression product] mutant prenyl diphosphate synthase according to claim 1 from the culture, wherein the mutant prenyl diphosphate synthase is produced by expression of the expression vector.

Claim 16. (Four Times Amended) A process for producing a prenyl diphosphate having not more than 15 carbons comprising the step of bringing [an enzyme] the mutant prenyl diphosphate synthase according to [claim] any one of claims 1, 3, [or any of claims 2 to] 4, 6 and 7 [10] or [an enzyme] the mutant prenyl diphosphate synthase produced by the method according to claim 15 into contact with a substrate selected from the group consisting of isopentenyl diphosphate, dimethylallyl diphosphate, and geranyl diphosphate.

Cancel claims 17-48.

Claim 49. The mutant prenyl diphosphate synthase of claim 1 having the amino acid sequence of SEQ ID NO:1 except that threonine at position 78 of SEQ ID NO:1 is replaced with phenylalanine replacing histidine at position 81 of SEQ ID NO:1 is replaced with alanine.

Claim 50. The mutant prenyl diphosphate synthase of claim 1 having the amino acid sequence of SEQ ID NO:1 except that threonine at position 78 of SEQ ID NO:1 is replaced with phenylalanine and histidine at position 81 of SEQ ID NO:1 is replaced with leucine.

Claim 51. The mutant prenyl diphosphate synthase of claim 1 having the amino acid sequence of SEQ ID NO:1 except that phenylalanine at position 77 of SEQ ID NO:1 is replaced with tyrosine, threonine at position 78 of SEQ ID NO:1 is replaced with phenylalanine, and histidine at position 81 of SEQ ID NO:1 is replaced with leucine.

Claim 52. The mutant prenyl diphosphate synthase of claim 1 having the amino acid sequence of SEQ ID NO:1 except that phenylalanine at position 77 of SEQ ID NO:1 is replaced with tyrosine, threonine at position 78 of SEQ ID NO:1 is replaced with phenylalanine, and histidine at position 81 of SEQ ID NO:1 is replaced with alanine.

Claim 53. The mutant prenyl diphosphate synthase of claim 1 having the amino acid sequence of SEQ ID NO:1 except that phenylalanine at position 77 of SEQ ID NO:1 is replaced with tyrosine, threonine at position 78 of SEQ ID NO:1 is replaced with serine, valine at position 80 of SEQ ID NO:1 is replaced with isoleucine, isoleucine at position 84 of SEQ ID NO:1 is

replaced with leucine, and proline and serine are inserted sequentially between position 84 and position 85 of SEQ ID NO:1.

Claim 54. The mutant prenyl diphosphate synthase of claim 1, wherin the mutant synthesizes more farnesyl diphosphate than the wild-type geranylgeranyl diphosphate synthase of *Sulfolobus acidocaldarius*.